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Memorandum

U.S. Department of Transportation
National Highway Traffic Safety Administration

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Subject: ACTION: Docket Submittal
Frontal Offset Crash Tests

Date: MAR 26 2004

From: Noble N. Bowie
Associate Administrator
for Planning, Evaluation and Budget

Reply to Attn. of:

To:

Docket

Thru: Jacqueline Glassman
Chief Counsel

Please submit the attached paper "Preliminary Lower Extremity Injury Benefits for Frontal Offset Crash Tests", March 2004, to Docket No. NHTSA-2003-15715-12.

Attachment

Distribution:
Senior Associate Administrator for Vehicle Safety
Associate Administrator for Rulemaking
Chief Counsel

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SAFETY BELTS SAVE LIVES

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Preliminary Lower Extremity Injury Benefits for Frontal Offset Crash Tests

Office of Regulatory Analysis and Evaluation
Planning, Evaluation, and Budget
NHTSA – March 2004

Overall Safety Problem

Annually, about 526,140 front-outboard occupants suffered a MAIS 1+ lower extremity injury in frontal crashes. The cost associated with these lower extremity injuries was $11.0 billion (2001 value). MAIS 2+ injuries accounted for 21% (110,409) of these injuries and 84% of the cost ($9.2 billion).

Target Population

About 84,811 (16%) had a MAIS 2+ injury in frontal offset crashes. The total cost of these injuries was $7.0 billion. There were 48,342 (57%) belted and 36,469 (43%) unbelted MAIS 2+ injuries. About 67,848 (80%) were drivers and 16,963 (20%) were front-outboard passengers. Table 1 lists these statistics. The frontal offset crashes would impact these MAIS 2+ lower extremity injuries.

Table 1
MAIS 2+ Lower Extremity Injuries

	50th Male			5th Female			50th +5th		
	Belted	Unbelted	Total	Belted	Unbelted	Total	Belted	Unbelted	Total
Drivers	30165	22756	52921	8508	6419	14927	38673	29175	67848
Passengers	7542	5690	13232	2127	1604	3731	9669	7294	16963
Total	37707	28446	66153	10635	8023	18658	48342	36469	84811

Source: 1995-2001 CDS

Benefits

The benefits estimates in Table 2 are based on the available vehicle test data. However, the benefits results are counterintuitive. This probably results from old model vehicles and a small sample size being tested at 56 and 60 kmph (see Table 3). One would expect to have a lower benefit at 60 kmph and a higher benefit at 64 kmph. The 64 kmph benefits were based on 47 tests and are the best estimates of potential benefits in the agency's opinion. The agency doesn't believe that we would get as large of a benefit as shown in Table 2 for 56 and 60 kmph tests if we had more test data. Benefits for 60 kmph would be expected to be similar to that at 64 kmph. Thor legs have instruments to measure calcaneus and foot/ankle injuries that are not measured by Denton Legs. Thus, the benefit estimates for Thor legs would include the benefits for Denton legs plus the additional benefits from calcaneus and foot/ankle injuries.

The MDB benefit estimates in Table 2 are also suspect. About 58 percent of the lower extremity injuries were knee-thigh-hip injuries. These injuries were measured by femur load. One MDB test had a high failure femur load and resulted in a significant increase in benefits over other ODB tests.

The belted 64 kmph left and right frontal offset tests with Thor legs together would reduce an estimated 1,362 - 3,057 MAIS 2+ lower extremity injuries and save about $113 - $254 million (undiscounted, 2001 value).

The belted 60 kmph left and right frontal offset tests with Thor legs together would reduce an estimated 3,592 – 8,067 MAIS 2+ lower extremity injuries and save about $298 - $670 million (undiscounted, 2001 value).

The belted 56 kmph left and right frontal offset tests with Denton legs together would reduce an estimated 569 - 1,277 MAIS 2+ lower extremity injuries and save about $47 - $106 million (undiscounted, 2001 value).

The belted 56 kmph left and right frontal offset tests with Thor legs together would reduce an estimated 2,300 – 4,684 MAIS 2+ lower extremity injuries and save about $191 - $389 million (undiscounted, 2001 value).

The belted MDB 105 kmph left and right frontal offset tests with Denton legs together would reduce an estimated 4,958 – 11,133 MAIS 2+ lower extremity injuries and save about $412 - $924 million (undiscounted, 2001 value).

Table 2
Lower Extremity Injury Benefits for Belted Frontal Offset Crashes*

	Lower Bound**		Higher Bound***	
	Injuries Reduced	$ Saved (Million)	Injuries Reduced	$ Saved (Million)
64 KMPH				
Denton	870	$72	1,954	$162
Thor	1,362	$113	3,057	$254
60 KMPH				
Denton	1,273	$106	2,858	$237
Thor	3,592	$298	8,067	$670
56 KMPH				
Denton	569	$47	1,277	$106
Thor	2,300	$191	4,684	$389
MDB (105 KMPH)				
Denton	4,958	$412	11,133	$924
Thor	ND	ND	ND	ND

*Left and right together
** From belted 50th males only
*** Including benefits from 5th females and unbelted occupants
ND – no test data

Note:

- The agency believes that the benefits at 64 kmph with Denton legs would more accurately represent the true benefits of offset crashes. These benefits were the lower bounds in the table. The benefits were based on 47 of the 150 tests conducted by IIHS. The 47 vehicles tested were model year 2000 and newer models.
- Benefits for Thor legs include the benefits for Denton legs and the additional benefits from calcaneus and foot/ankle injuries.
- The higher bounds of the benefits took into account the benefits for 5th females and unbelted occupants. The analysis assumed the same effectiveness regardless of dummy size and belt use status, i.e., the effectiveness of tests with belted 50th males was applied to the 5th females, belted, and unbelted occupants.
- There are no unbelted offset tests. We need unbelted tests to quantify unbelted benefits.
- Test results comparing 60 and 64 kmph are counterintuitive, possibly due to the small number of tests for 60 kmph.
- Benefits for 56 kmph were based on three vehicle tests with 50th and two with 5th from VRTC. These tests used Thor-Lx legs. Benefits for MDB were based on 4 tests with Denton legs. One of them had 1 bad femur failure that resulted in a significant increase in benefits.
- All the estimates did not consider potential disbenefits from increased stiffness of the vehicles.

Table 3
Number of Tests for Belted Frontal Offset Tests

56 kmph*				60 kmph				64 kmph		MDB
50th Male		5th Female		50th Male		5th Female		50th Male		105 kmph
Denton	Thor	Denton	Thor	Denton	Thor	Denton	Thor	Denton**	Thor	Denton
3*	3	0	2	7	4	7	6	47	2	4

* Denton from Transport Canada, tested with old model year vehicles; Thor-Lx from VRTC
** Out of 150 tests conducted by IIHS